

三维颌骨模型在髁突外脱位治疗中的应用

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[摘 要] **目的:**探讨三维颌骨模型及其模型外科在外伤性髁突外脱位复位治疗中的应用。**方法:**选取9例下颌骨颞部骨折伴髁突外脱位患者,术前行CT扫描并通过快速成型技术制作三维颌骨模型。分析模型髁突外脱位的情况,进行模型外科操作,复位颞部骨折及髁突外脱位并预制个性化重建钛板。术中利用预制的重建钛板配合颌关系的引导,将颞部骨折复位。**结果:**9例患者在三维颌骨模型外科指导下完成手术,创口均Ⅰ期愈合,颌关系恢复,术后影像学检查见9例患者髁突均完全复位。术后随访6~28个月,患者最大张口度3.1~4.2 cm(中位数3.3 cm),颌关系及颌骨运动功能均正常。**结论:**三维颌骨模型能全面显示颞部骨折和髁突外脱位情况,利用颌骨的三维模型外科作为平台,可以准确塑形颞部重建钛板,在颞部骨折手术复位的同时将髁突外脱位复位,从而在外伤性髁突外脱位复位治疗中起到良好的辅助作用。

[关键词] 下颌骨折/外科学;下颌骨髁状突/外科学;下颌骨髁状突/放射摄影术;脱位/治疗;体层摄影术,X线计算机;模型,解剖学;随访研究

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Application of three-dimensional model in treatment of superolateral dislocation of mandibular condyle

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[Abstract] **Objective:** To assess the application of three-dimensional jaw model in treatment of superolateral dislocation of condyle. **Methods:** Nine patients with superolateral dislocation of condyle and symphyseal fractures were admitted in hospital from June 2008 to June 2013. Spiral CT scan on maxilla and mandible was performed, and three-dimensional jaw model was constructed with rapid prototyping technology. According to conditions of condylar superolateral dislocation model, the operation scheme was designed. The symphyseal fracture line was made and fracture was reduced on three-dimensional jaw model. Individualized prefabricated reconstructive titanium

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plate was made on symphyseal fracture model. Symphyseal fracture was replaced with individualized prefabricated mandibular reconstruction titanium plate according to occlusal relationship. At the same time, reduction of condylar superolateral dislocation was accomplished. **Results:** Operations were successfully completed in 9 cases under guidance of three-dimensional jaw model surgery. Operative incision was primarily healed, and occlusal relationship was restored. Postoperative CT scan showed that the locations of condyle in 9 cases were completely restored. Patients were followed-up for 6-28 months with a median of 18 months. The maximum of mouth opening was 3.1-4.2 cm with a medians of 3.3 cm, and the occlusal relationship of all patients was normal after surgery. **Conclusion:** Three-dimensional jaw model can show complete status of condylar superolateral dislocation and symphyseal fracture. The model can accurately shape symphyseal reconstructive titanium plate and restore condylar superolateral dislocation during reductive surgery.

[**Key words**] Mandibular fractures/surgery; Mandibular condyle/surgery; Mandibular condyle/radiography; Dislocations/therapy; Tomography, X-Ray computed; Models, anatomic; Follow-up studies

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下颌骨骨折中颏部骨折伴髁突外脱位在临床上比较少见^[1]。由于下颌骨失去整体性,部分患者常伴有一侧或双侧髁突囊内矢状骨折,常规小钛板固定往往难以准确复位髁突外脱位,目前临床上尚缺乏明确有效的治疗方法。2008年1月至2013年6月,浙江大学医学院附属第二医院口腔颌面外科共收治了9例颏部骨折伴髁突外脱位患者,术前采用CT扫描后快速成型技术制作三维颌骨模型,在模型上切开并复位颏部骨折,颏部骨折处预制个性化下颌医用重建钛板;术中利用预制的重建钛板配合咬颌关系的引导,在颏部骨折复位固定的同时将双侧髁突外脱位予以复位,取得了良好的效果。

1 对象与方法

1.1 对 象

9例患者中男性7例,女性2例,年龄5~48岁(中位数39岁)。致伤原因:跌伤3例,车祸伤6例。其中8例患者存在双侧髁突外脱位,1例存在左侧髁突外脱位(颏部粉碎性骨折);6例为一侧髁突囊内骨折,2例为双侧髁突囊内骨折,1例无髁突骨折。所有患者均有颏部骨折,其中颏部非线性骨折5例,粉碎性骨折4例。患者到浙江大学医学院附属第二医院口腔颌面外科就诊时张

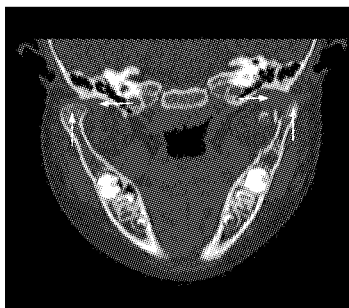
口度0.2~1.5 cm,平均 (0.94 ± 0.20) cm;就诊距外伤时间1~5 d,中位数4 d;接受手术距外伤时间5~10 d,平均 (7.56 ± 1.42) d。术前对伴有髁突骨折的患者详细告知其髁突囊内骨折的闭合性与开放性治疗利弊及可能的并发症^[2-3]。所有患者均要求先行髁突骨折的闭合性保守治疗,之后依据功能锻炼情况再决定是否进一步治疗,并签署术前知情同意书。

1.2 三维颌骨模型制作

术前患者行上、下颌骨螺旋CT扫描,CT机为Simens Plus IV型,层厚1 mm,螺距1.5,以1 mm重建,选择骨窗,CT机自带图像软件处理获得二维切片图像显示髁突外脱位及骨折情况(图1)。将患者的CT扫描数据以标准格式(Dicom)输出并用电子邮件发送至浙江大学机械设计研究所快速成型中心。通过软件将CT二维数据转化成三维数字模型,转化后的数据输入到COLYTECH激光快速成形机。快速成形机运用自带的分层软件Speda以0.12 mm间距重新分层并完成各层的轮廓编辑和激光的运动轨迹计算,以预先计算好的加工程序加工模型,拨除废料并修正(图2)。

1.3 模型外科操作

在三维颌骨模型上沿下颌骨颏部错位骨折线



箭头所示为脱位和骨折处。

图1 术前 CT 摄片示双侧髁突外脱位及左髁突骨折

Fig.1 Pre-operative CT image shows lateral dislocation of the bilateral condyles with associated mid-symphyseal fracture



箭头所示为脱位和骨折处。

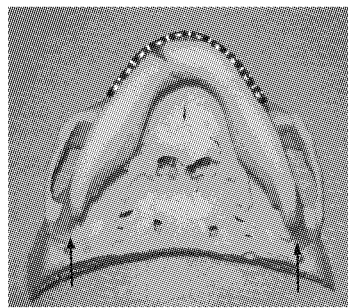
图2 三维颌骨模型见双侧髁突位于关节窝外侧

Fig.2 Three-dimensional model of lateral dislocation of the bilateral condyles

切开后重新拼接,以上、下颌牙列咬颌关系的恢复为引导,使外脱位的髁突回到关节窝的正常位置(图3),然后弯制、塑型下颌医用重建钛板(宁波慈北医疗器械有限公司生产),使之与下颌骨颏部及下颌体部表面密切贴合。此时上下颌牙列的咬颌关系由紊乱状态恢复至正常咬颌状态,见图4。然后将已经弯塑型好的重建钛板及颌骨模型无菌消毒备用。

1.4 手术方法及术后处理

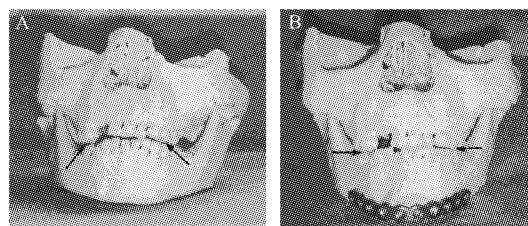
①经鼻气管插管全身麻醉后,常规口内唇颊沟作切口暴露下颌骨颏部骨折区(颏下区有创口的患者可选用原创口入路);②去除颏部骨折间的肉芽组织,利用预制的下颌重建钛板指导和配合咬颌关系的恢复,将颏部骨折完全复位;③固定预制下颌重建钛板,确保固定位置与模型外科操作时的固定位置完全一致并与下颌骨颏部和体部表面贴合,同时手法检查髁突外脱位是否已经复位;④术后视患者颌关系情况可加用颌间牵引1



颏部骨折复位,预制下颌重建钛板,双侧髁突外脱位复位。箭头所示为脱位和骨折处。

图3 模型外科操作

Fig.3 Reduction of bilateral condyles after model surgery



A:模型外科前咬颌状态紊乱;B:模型外科后的咬颌状态恢复正常。箭头所示。

图4 模型外科前后咬颌状态

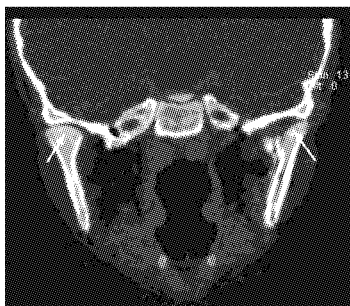
Fig.4 The occlusal relationship before and after model surgery

周,解除颌间牵引后进行张口训练3~6个月。

2 结果

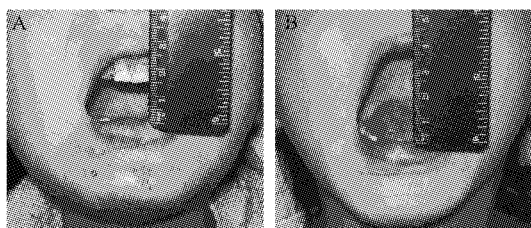
9例患者虽然手术时骨折区已有肉芽组织形成,但去除纤维肉芽组织后,在模型外科预制的下颌医用重建钛板的指导和颌关系恢复的配合下,均能迅速使颏部骨折和髁突外脱位解剖复位,手术时间明显缩短,无一例复位不足或复位过度。所有患者颏部颌下创口及髁突手术创口均I期愈合,颌关系恢复良好。术后1周CT复查,均显示髁突位于关节窝正常解剖位置(图5),颏部骨折对位对线良好。7例患者(包括2名儿童患者)术后5~10个月再次手术取出重建钛板,术后恢复良好;另2例因为患者无不适,没有手术取钛板。

术后随访6~28个月(中位数18个月),9例患者颌关系均恢复正常;术前的重度张口度受限,术后恢复到最大张口度3.1~4.2 cm(中位数3.3 cm),如图6。其中3例患者存在2.0~3.5 mm的张口偏斜(偏向髁突骨折侧);所有患者咀嚼功能基本恢复正常。



箭头所示为脱位和骨折处。

图5 术后CT摄片示双侧髁突外脱位完全复位
Fig.5 Postoperative CT image shows both the condyles in glenoid fossa



A:术前张口重度受限;B:术后恢复正常张口度。

图6 术前张口程度及术后6个月的恢复情况
Fig.6 The maximum of mouth opening before and 6 months after operation

3 讨论

颌面部创伤中,摔倒、碰撞等对冲性外力引起的颞部骨折非常常见。当冲击力较强时,常导致颞下颌关节的关节囊撕裂,髁状突从关节窝中脱出,形成髁突外脱位,部分患者还伴发髁突骨折^[4]。CT扫描可以清晰地呈现髁突骨折全貌,因此诊断不难^[5]。髁突外脱位限制了髁突正常的生理运动轨迹,会出现髁突与颅底骨壁的紧密接触,以及关节囊损伤后组织液渗出致血肿机化等,若不及时处理往往会形成关节强直等后遗症^[6]。

与开口过大引起的髁突前脱位机制完全不同,颞部对冲伤引起颞部骨折伴髁突外脱位的临床处理要困难得多,主要体现在:①髁突脱位或伴发髁突骨折后,关节窝内软组织填充、血肿机化和纤维化常常导致髁突复位困难,颞部的小钛板固定由于力量薄弱一般难以将脱位髁突复位;②临床上可直接以重建钛板固定颞部骨折,但能否准确复位髁突外脱位难以把握,复位不足或过度复位仍会导致张口受限及颌功能障碍。在应用个体化头颅模型分析研究之前,我科类似的2例双侧

髁突外脱位患者均治疗失败:1例行直视下髁突复位加颞部骨折小钛板固定,后行颌间结扎,术后影像学检查均显示髁突复位失败,第三次手术不得不行髁突高位切除;另1例术中根据临床经验及目测弯制重建钛板固定颞部骨折,影像学检查显示髁突外脱位复位,但1年内患者出现了双侧关节强直。由此可见,颞部骨折伴双侧髁突外脱位仍是颌面创伤处理中的一个难点。

20世纪60年代,Allen等^[7]报道了外伤性髁突外脱位并进行了分类。目前,临床上对于不伴有骨折的完全性髁突外脱位(包括前上和外侧脱位)的报道相对较多,通过开放性手术及闭合性治疗均能够完全复位,治疗效果明确^[4,8-11]。对于髁突骨折外脱位,Radhakrishna等^[12]主张在外伤后尽早(1周内)进行复位以防止纤维粘连。Amaral等^[13]报道了1例全面骨折患者,外伤当天行手法复位结合颌间结扎,术后髁突外脱位完全复位,5个月后张口度恢复到3.0 cm。对于伴有单侧髁突外脱位的下颌骨颞部或体部骨折,复位的同时骨折区可以以小钛板进行内固定;对伴有双侧髁突外脱位的骨折,一般主张以重建钛板进行固定^[14]。但对于如何进行重建钛板塑形以及处理伴有下颌骨粉碎性的骨折,目前尚未见文献报道。

目前,快速成型技术制作三维仿真颌骨模型已广泛应用于口腔颌面先天畸形、各种原因导致的颅颌面骨缺损诊治、正颌外科、牵引成骨、颌面肿瘤的诊断和治疗、口腔科学的教学和科研^[15]。计算机模拟制造实现了颅颌面骨组织的精确复制,Arvier等^[16]认为颌骨模型的准确性与CT扫描参数有关,扫描层距越小,准确性越高。本研究中所取CT扫描像素足够小,三维颌骨模型的精确度完全可以满足模型外科的需要。本研究利用三维颌骨模型精确显示了下颌骨骨折全貌,包括颞部骨折线的数量、走向、移位情况、是否粉碎性骨折、是否存在骨缺损、双侧髁突骨折移位情况、髁突外脱位程度。模型外科过程确定了医用重建钛板的形状、弯曲弧度、固位孔的位置,手术中辅助以咬颌关系恢复,预制的医用重建钛板能够快速准确地就位,明显缩短了手术时间,减少了手术创伤,降低了手术风险,有利于术后恢复。医用重建钛板强度足够,可防止因血肿机化形成肉芽组织导致脱位性髁突的复位困难。

对于颈部粉碎性骨折或牙列缺失无法确定咬颌关系时,模型外科预制医用重建钛板的作用显得尤为重要。髁突外脱位复位无法在直视下进行,手术过程中重建钛板的准确就位能够保障髁突外脱位的准确复位。同时,预制的医用重建钛板根据颈部骨折复位后正确形态进行塑形,与手术区域骨组织形态相吻合,固定后贴合密切,降低了因重建钛板贴合欠佳引起局部应力导致螺钉松动而对下颌骨形态产生影响^[17]。

对大多数患者而言,张口度达3 cm以上或被张口训练有较明显改善,髁突骨折可予以保守治疗。本研究9例髁突骨折患者髁突复位后张口度均基本恢复正常,这与重建钛板固定后下颌颈部骨折区强度增加,可以在术后早期进行张口训练有关。

国外有文献报道,髁突的外上方脱位可能导致面神经损伤症状^[18-19]。这是由于髁突外上方脱位时下颌骨升支的挤压造成面神经主干损伤,从而导致永久或暂时性面神经麻痹。本组9例患者均未出现面神经麻痹症状。

参考文献:

- [1] RATTAN V. Superolateral dislocation of the mandibular condyle: report of 2 cases and review of the literature [J]. **J Oral Maxillofac Surg**, 2002, 60(11):1366-1369.
- [2] BAKER A W, MCMAHON J, MOOS K F. Current consensus on the management of fractures of the mandibular condyle. A method by questionnaire [J]. **Int J Oral Maxillofac Surg**, 1998, 27(4):258-266.
- [3] ECKELT U, SCHNEIDER M, ERASMUS F, et al. Open versus closed treatment of fractures of the mandibular condylar process-a prospective randomized multi-centre study [J]. **J Cranio-maxillofac Surg**, 2006, 34(5):306-314.
- [4] LI Z, LI Z B, SHANG Z J, et al. An unusual type of superolateral dislocation of mandibular condyle: discussion of the causative mechanisms and clinical characteristics [J]. **J Oral Maxillofac Surg**, 2009, 67(2):431-435.
- [5] 段登辉, 张益. 髁突矢状骨折CT和MRI诊断及相关性研究[J]. **中华口腔医学杂志**, 2010, 45(1):2-5.
DUAN Deng-hui, ZHANG Yi. A comparative study of two imaging techniques for the diagnosis of sagittal fracture of mandible condyle [J]. **Chinese Journal of**
- Stomatology**, 2010, 45(1):2-5. (in Chinese)
- [6] HE D, ELLIS E 3RD, ZHANG Y. Etiology of temporomandibular joint ankylosis secondary to condylar fractures: the role of concomitant mandibular fractures [J]. **J Oral Maxillofac Surg**, 2008, 66(1):77-84.
- [7] ALLEN F J, YOUNG A H. Lateral displacement of the intact mandibular condyle. A report of ve cases [J]. **Br J Oral Surg**, 1969, 7(1):24-30.
- [8] BU S S, JIN S L, YIN L. Superolateral dislocation of the intact mandibular condyle into the temporal fossa: review of the literature and report of a case [J]. **Oral Surg Oral Med Oral Pathol Oral Radiol Endod**, 2007, 103(2):185-189.
- [9] PAPADOPOULOS H, EDWARDS R S. Superolateral dislocation of the condyle: report of a rare case [J]. **Int J Oral Maxillofac Surg**, 2010, 39(5):508-510.
- [10] HEGDE S, KAMATH V V, DEEPA M, et al. Superolateral dislocation of the mandibular condyle not associated with fracture: a case report [J]. **J Maxillofac Oral Surg**, 2010, 9(4):424-427.
- [11] PRABHAKAR V, SINGLA S. Bilateral anterosuperior dislocation of intact mandibular condyles in the temporal fossa [J]. **Int J Oral Maxillofac Surg**, 2011, 40(6):640-643.
- [12] RADHAKRISHNA S, RAMESH B. Rare case of superolateral dislocation of the condyle [J]. **Oral Maxillofac Surg**, 2013, 17(1):59-61.
- [13] AMARAL M B, BUENO S C, SILVA A A, et al. Superolateral dislocation of the intact mandibular condyle associated with panfacial fracture: a case report and literature review [J]. **Dental Traumatology**, 2011, 27:235-240.
- [14] SHEN L, LI P, LI J, et al. Management of superolateral dislocation of the mandibular condyle: a retrospective study of 10 cases [J]. **J Craniomaxillofac Surg**, 2014, 42(1):53-58.
- [15] 徐昕, 平飞云, 陈军, 等. 计算机辅助技术在下颌骨缺损修复中的应用 [J]. **中华口腔医学杂志**, 2007, 42(8):492-495.
XU Xin, PING Fei-yun, CHEN Jun, et al. Application of computer aided design/computer aided manufactured techniques in mandible defect reconstruction [J]. **Chinese Journal of Stomatology**, 2007, 42(8):492-495. (in Chinese)
- [16] ARIVER J F, BARKER T M, YAU Y Y, et al. Maxillofacial biomodelling [J]. **Br J Oral Maxillofac Surg**, 1994, 32(5):276-283.

(下转第596页)

- [7] KIM M G, KAWADA H, KIM B S, et al. A totally laparoscopic distal gastrectomy with gastroduodenostomy (TLDG) for improvement of the early surgical outcomes in high BMI patients [J]. **Surg Endosc**, 2011,25(4):1076-1082.
- [8] KIM B S, YOOK J H, CHOI Y B, et al. Comparison of early outcomes of intracorporeal and extracorporeal gastroduodenostomy after laparoscopic distal gastrectomy for gastric cancer [J]. **J Laparoendosc Adv Surg Tech A**, 2011,21(5):387-391.
- [9] LEE J, KIM D, KIM W. Comparison of laparoscopy-assisted and totally laparoscopic Billroth-II distal gastrectomy for gastric cancer [J]. **J Korean Surg Soc**, 2012,82(3):135-142.
- [10] KIM D G, CHOI Y Y, AN J Y, et al. Comparing the short-term outcomes of totally intracorporeal gastroduodenostomy with extracorporeal gastroduodenostomy after laparoscopic distal gastrectomy for gastric cancer: a single surgeon's experience and a rapid systematic review with meta-analysis [J]. **Surg Endosc**, 2013,27(9):3153-3161.
- [11] ZENG Y K, YANG Z L, PENG J S, et al. Laparoscopy-assisted versus open distal gastrectomy for early gastric cancer: evidence from randomized and nonrandomized clinical trials [J]. **Ann Surg**, 2012,256(1):39-52.
- [12] OKI E, SAKAGUCHI Y, OHGAKI K, et al. The impact of obesity on the use of a totally laparoscopic distal gastrectomy in patients with gastric cancer [J]. **J Gastric Cancer**, 2012,12(2):108-112.
- [13] BALLESTA-LOPEZ C, BASTIDA-VILA X, CATARCI M, et al. Laparoscopic Billroth II distal subtotal gastrectomy with gastric stump suspension for gastric malignancies [J]. **Am J Surg**, 1996,171(2):289-292.
- [14] 徐晓武, 牟一平, 严加费, 等. 完全腹腔镜胃癌根治术的临床应用[J]. **中华医学杂志**, 2010,90(6):386-389.
XU Xiao-wu, MOU Yi-ping, YAN Jia-fei, et al. Totally laparoscopic gastrectomy for gastric cancer [J]. **Natl Med J China**, 2010,90(6):386-389. (in Chinese)
- [15] KITANO S, SHIRAIISHI N, UYAMA I, et al. A multicenter study on oncologic outcome of laparoscopic gastrectomy for early cancer in Japan [J]. **Ann Surg**, 2007,245(1):68-72.
- [16] KIM W, SONG K Y, LEE H J, et al. The impact of comorbidity on surgical outcomes in laparoscopy-assisted distal gastrectomy: a retrospective analysis of multicenter results [J]. **Ann Surg**, 2008,248(5):793-799.
- [17] 杜建军, 双剑博, 郑建勇, 等. 完全腹腔镜与腹腔镜辅助胃癌根治术的比较[J]. **中华普通外科杂志**, 2011,26(1):1-4.
DU Jian-jun, SHUANG Jian-bo, ZHENG Jian-yong, et al. A comparison of total laparoscopic gastrectomy and laparoscopy-assisted gastrectomy for gastric carcinoma [J]. **Chinese Journal of General Surgery**, 2011,26(1):1-4. (in Chinese)

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(上接第 576 页)

- [17] 张益. 全面部陈旧性骨折回顾性分析与临床分类研究[J]. **中华口腔医学杂志**, 2008, 43(4): 231-235.
ZHANG Yi. Delayed pan-facial fractures-injury patterns associated with deficient treatment results and clinical classification[J]. **Chinese Journal of Stomatology**, 2008, 43(4):231-235. (in Chinese)
- [18] BRUSATI R, PAINI P. Facial nerve injury secondary to lateral displacement of the mandibular ramus [J]. **Plast Reconstr Surg**, 1978, 62(5):728-733.
- [19] FERGUSON J W, STEWART I A, WHITLEY B D. Lateral displacement of the intact mandibular condyle. Review of literature and report of case with associated facial nerve palsy [J]. **J Craniomaxillofac Surg**, 1989,17(3):125-127.

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